

# PATENT ABSTRACTS OF JAPAN

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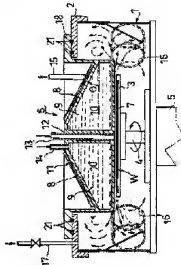
(72)Inventor : ECHIGO TOMOMI

(54) SPIN SINGLE-WAFER BASIS PROCESSING APPARATUS FOR SEMICONDUCTOR WAFER

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate the need for air flow control inside a chamber and permit cluster tool formation by completely eliminating reattachment of mist and contamination to a wafer surface.

SOLUTION: A ultrasonic vibration device 6 is arranged in an upper side of a wafer pad 3. The ultrasonic vibration device 6 is provided with at least a plate-like top plate 7 facing in proximity to cover a wafer surface with a little clearance between it and a semiconductor wafer W, a speaker-cone shape vibration plate 8 and a ultrasonic vibrator 11. A space part between the top plate 7 and the vibration plate 8 is made a tank part 10 for storing a ultrasonic transmission medium 9, which transmits ultrasonic vibration and a supply nozzle 13 for spraying cleaning liquid, rinsing liquid and drying gas one by one to a surface of the semiconductor wafer W which rotates at a fast speed is made to face toward a rotation axis position of the wafer pad 3 from a center position of the top plate 7. The ultrasonic vibration device 6 is reciprocated ranging over a distance of at least the radius size of a semiconductor wafer parallel to the surface of a semiconductor wafer.



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(71) 出願人 000124959

株式会社カイジョー

東京都羽村市栄町3丁目1番地の5

(72) 発明者 越後 智美

東京都羽村市栄町3丁目1番地の5 株式会社カイジョー内

(74) 代理人 100097021

弁理士 藤井 紘一 (外1名)

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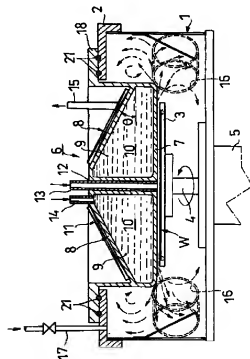
B386 BB93 CC01 CC12 CC11

## (54) 【発明の名称】 半導体ウェハのスピンの枚数処理装置

## (57) 【要約】

【課題】 ウェハ表面へのミストの再付着や汚染を完全に無くし、チャンバー内の気流コントロールを不要とするとともに、クラスタツール化を可能とする。

【解決手段】 ウェハ受け台3の上部側に超音波振動装置6を配設し、該超音波振動装置は、少なくとも、半導体ウェハWとの間に僅かの間隙を有してウェハ表面を覆うように近接して対向配置された平板状の天板7と、スピーカコーン形振動板8と、超音波振動子11とを備え、前記天板7と振動板8との間の空間部を超音波振動を伝達する超音波伝達媒体9を貯溜するためのタンク部10とするとともに、高速回転する半導体ウェハWの表面に洗浄液、すすぎ液、乾燥用のガスを順に吹き付けるための供給ノズル13を前記天板7の中心位置からウェハ受け台3の回転軸心位置に向けて臨ませた。超音波振動装置6は、その全体を半導体ウェハの表面と平行に半導体ウェハの半径寸法以上の距離にわたって往復動させる。



これらのミストがウェハ表面に再付着することがなくなる。このため、ウェハの再汚染を防止することができる。

【0044】また、ウェハ表面に超音波を均等に照射しながら、洗浄、すすぎ、乾燥の各処理を行なうようにしているため、表面処理の均一性が向上し、ウェハの処理品質を向上することができる。また、乾燥処理に使用した後の乾燥用ガスやチャンパー内大気の影響を受けることがないので、これらにガスや大気によってウェハが汚染されることがなくなり、スピンドル処理装置をクラスツール化することができる。

【0045】また、請求項2記載の発明によれば、超音波振動装置を半導体ウェハの表面と平行に半導体ウェハの半径寸法以上の距離にわたって往復動させるようにしたので、ウェット処理のための液体や気体を高速回転する半導体ウェハの表面全面に万遍なく吹き付けることができる。このため、処理を高速化することができるとともに、ウェハの中心位置一箇所に固定的に吹き付けることによるウェハ表面の傷の発生なども防止することができる。

【0046】また、請求項3記載の発明によれば、タンク部への超音波伝達媒体供給口をスピーカコーン形振動板のコーン先端側に設けるとともに、タンク部からの超音波伝達媒体排出口をスピーカコーン形振動板のコーン裾部側周縁に設けたので、タンク部内で発生する気泡や超音波振動に伴う発熱を自然に外部へ排出することができる。安定した処理動作を行なわせることができる。

【0047】また、請求項4記載の発明によれば、液体および気体の供給ノズルを、スピーカコーン形振動板とタンク部の中心部を垂直に貫いて天板中心位置まで配管したので、超音波振動装置の超音波発生機構部分が360°の全方向にわたって対称構造となり、超音波をより均一にウェハ表面に照射することができる。このため、

表面処理の均一性が向上し、ウェハの処理品質をより一層向上することができる。

【図面の簡単な説明】

【図1】図2中のA-A矢視断面図である。

【図2】本発明に係るスピンドル処理装置の一実施の形態の平面図である。

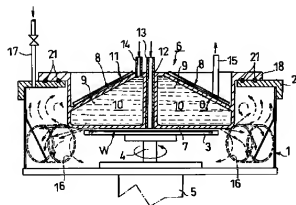
【図3】従来装置の略示断面図である。

【図4】従来装置の平面図である。

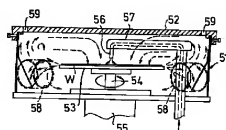
【符号の説明】

- W 半導体ウェハ
- r ウェハの半径寸法
- 1 チャンパー
- 2 蓋部
- 3 ウェハ受け台
- 4 回転軸
- 5 モータ
- 6 超音波振動装置
- 7 天板
- 8 スピーカコーン形振動板
- 9 超音波伝達媒体
- 10 タンク部
- 11 超音波振動子
- 12 円筒状の孔
- 13 液体と気体の供給ノズル
- 14 超音波伝達媒体供給口
- 15 超音波伝達媒体排出口
- 16 排気口
- 17 通風口
- 18 鍔部
- 19 シリンダ
- 20 ピストンロッド
- 21 Oリング

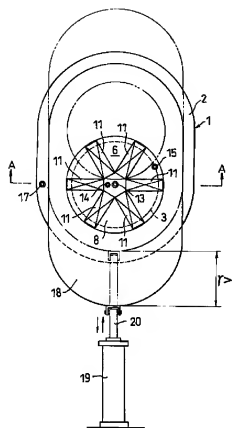
【図1】



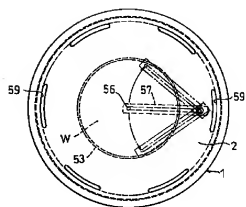
【図3】



【圖2】



【圖4】



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#### CLAIMS

[Claim]

[Claim 1] High-speed rotation of the wafer cradle which laid the semiconductor wafer within the chamber of a direct vent system is carried out. By spraying a liquid and a gas required for wet processing of a penetrant remover, rinse liquid, the gas for xeraxis, etc. in order towards the front face of this semiconductor wafer that carries out high-speed rotation In the spin sheet processor of the semiconductor wafer which was made to perform each one processing of washing, a rinse, and xeraxis per wafer at a time The supersonic-oscillation equipment for irradiating an ultrasonic wave towards the aforementioned semiconductor wafer is located in the top side of a wafer cradle, and contiguity arrangement is carried out towards the wafer cradle. this supersonic-oscillation equipment The plate-like top plate by which opposite arrangement was carried out by approaching a wafer cradle so that it might have few clearances between the semiconductor wafers laid on the aforementioned wafer cradle and the whole surface on the front face of a wafer might be worn to it at least, The loudspeaker cone type diaphragm which is located in the upper part side of this top plate, and has been arranged towards a top plate, It has one piece or two or more ultrasonic vibrators which were \*\*\*\*ed by the outside surface of this loudspeaker diaphragm. While the space section between the loudspeaker cone type diaphragms arranged at its aforementioned top-plate [ plate-like ] and upper part side is made into the tank section for \*\*\*\*ing an ultrasonic transmission medium The spin sheet processor of the semiconductor wafer characterized by making a semiconductor wafer turn and face the supply nozzle which sprays the liquid and gas for wet processing in order towards the front face of the semiconductor wafer which carries out high-speed rotation from the center position of the aforementioned top plate.

[Claim 2] The spin sheet processor of the semiconductor wafer of the claim 1 publication characterized by making the aforementioned supersonic-oscillation equipment reciprocate to the front face of a semiconductor wafer, and parallel covering the distance more than the radius dimension of a semiconductor wafer.

[Claim 3] The claim 1 characterized by preparing the ultrasonic transmission medium exhaust port from the tank section in the cone \*\*\*\* side circumference of the aforementioned loudspeaker cone type diaphragm while the ultrasonic transmission medium feed hopper to the tank section is prepared in the cone tip side of the aforementioned loudspeaker cone type diaphragm, or the spin sheet processor of a semiconductor wafer given in two.

[Claim 4] The spin sheet processor of a semiconductor wafer given in either of the claims 1-3 characterized by having pierced through the supply nozzle of the aforementioned liquid and a gas perpendicularly, and piping the core of a loudspeaker cone type diaphragm and the tank section to a top-plate center position in it.

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DETAILED DESCRIPTION

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[Detailed description]

[0001]

[The technical field to which invention belongs] this invention relates to the spin sheet processor which was made to perform a series of one surface treatment, such as washing of a semiconductor wafer, a rinse, and xeraxis, per wafer at a time.

[0002]

[Prior art] The structure of the conventional spin sheet processor is shown in drawing 3 and drawing 4. Conventionally, drawing 3 is sketch drawing of longitudinal section of equipment, and drawing 4 is the plan. In drawing, 51 is the chamber of the shape of a cylinder which had the interior sealed by the lid 52, and the disc-like wafer cradle 53 for laying horizontally semiconductor wafer (following, "wafer", and abbreviated name) W in this chamber 51, and carrying out high-speed rotation is arranged free [rotation]. It connects with the motor 55 through the rotation axis 54, and by turning on and turning off a motor 55, this wafer cradle 53 is constituted so that it can rotate free.

[0003] Moreover, it is rinse liquid, such as penetrant removers, such as the supply nozzle 56 to an organic solvent, and a pure water, and N2, the \*\*\*\* arm 57 equipped with the supply nozzle 56 being formed at the nose of cam at the top side of the wafer cradle 53, and shaking the \*\*\*\* arm 57 at right and left. It is constituted so that the gas for xeraxis of gas etc. can be sprayed towards wafer W laid on the wafer cradle 53 in order. In addition, 58 is an exhaust port and 59 is a fresh air inlet.

[0004] The conventional spin sheet processor which becomes the above-mentioned configuration is used as follows. First, the opening-and-closing door of the wafer receipts-and-payments opening (not shown) prepared in the side-attachment-wall section of a chamber 1 etc. is opened, after carrying wafer W made into a processing object on the wafer cradle 3, a door is closed and the inside of a chamber 1 is sealed. Next, a motor 55 is driven and high-speed rotation of the wafer cradle 53 is carried out at the rate of predetermined. In this status, penetrant removers, such as an organic solvent, are \*\*\*\*ed for the supply nozzle 56 from the medical fluid feeder not to illustrate, a penetrant remover is sprayed towards the front face of wafer W which carries out high-speed rotation, shaking the movable arm 57 at right and left, and a wafer front face is washed.

[0005] Next, it rinses towards the front face of wafer W which carries out high-speed rotation while it rinses, rinse liquid, such as a pure water, is \*\*\*\*ed for the supply nozzle 56 from a liquid feeder and the movable arm 57 is shaken at right and left not to illustrate, and rinses by spraying liquid and flushing the penetrant remover adhering to the wafer front face.

[0006] Next, it is N2 from the gas supply system which omitted illustration to the supply nozzle 56. The gas for xeraxis of gas etc. is \*\*\*\*ed, and it sprays towards the front face of wafer W which carries out high-speed rotation, shaking the movable arm 57 at right and left, and xeraxis processing on the front face of a wafer is performed.

[0007] If the above-mentioned xeraxis processing is completed, while a motor 55 will be suspended, wafer W which processing finished will be taken out from the inside of a chamber 51 and it will transport to the following process, the following wafer W is carried on the wafer cradle 53, and a series of above-mentioned processing is repeated. thus -- while rotating wafer W (spin) -- each processing of washing, a rinse, and xeraxis -- it performs one sheet at a time

[0008]

[Object of the Invention] However, since the movable arm 57 which attached the supply nozzle 56 and this was equipped in the chamber 51 in the case of the conventional spin sheet processor mentioned above, the capacity of a chamber became large and there was a problem that control of a chamber bashful style was difficult. For this reason, it was easy too much the penetrant remover, and liquid collided with the chamber wall, and when it became Myst and it soared, it rode on the draft (arrow head of the dotted line in drawing 2) accompanied by high-speed rotation of the wafer cradle 53 sprayed on the front face of wafer W, the reattachment was carried out to the wafer front face, and it had become the cause of particle contamination.

[0009] Moreover, although the so-called cluster tool-ization exchanged between each other equipments, without connecting various processors with a pin center, large robot through a loading lock chamber (load lock chamber), and making the open air touched with a wafer is the very effective technique for the pollution control of a wafer, it requires that there should be no possibility that a wafer may be polluted to realize this.

[0010] However, in equipment, it is N2 for xeraxis conventionally which was mentioned above. When gas and the atmospheric air in a chamber were polluted by Myst and evaporative gas which remain in a chamber, such as an organic solvent, these pollutants rode on the draft in a chamber 51, the wafer front face was contacted, and there was a possibility of re-soiling a wafer. For this reason, as for the conventional spin sheet processor, cluster tool-ization also had the problem are difficult.

[0011] It aims at offering the spin sheet processor of the semiconductor wafer which enabled cluster tool-ization while this invention was made in order to solve the above problems, it loses completely the reattachment of Myst on the front face of a wafer, and contamination and makes draft control in a chamber unnecessary. [0012]

[The means for solving a technical problem] In order to attain the above-mentioned purpose, this invention carries out high-speed rotation of the wafer cradle which laid the semiconductor wafer within the chamber of a direct vent system. By spraying a liquid and a gas required for wet processing of a penetrant remover, rinse liquid, the gas for xeraxis, etc. in order towards the front face of this semiconductor wafer that carries out high-speed rotation In the spin sheet processor of the semiconductor wafer which was made to perform each one processing of washing, a rinse, and xeraxis per wafer at a time The supersonic-oscillation equipment for irradiating an ultrasonic wave towards the aforementioned semiconductor wafer is located in the top side of a wafer cradle, and contiguity arrangement is carried out towards the wafer cradle. this supersonic-oscillation equipment The plate-like top plate by which opposite arrangement was carried out at the wafer cradle so that it might have few clearances between the semiconductor wafers laid on the aforementioned wafer cradle and the whole surface on the front face of a wafer might be worn to it at least, The loudspeaker cone type diaphragm which is located in the upper part side of this top plate, and has been arranged towards a top

plate, It has one piece or two or more ultrasonic vibrators which were \*\*\*\*ed by the outside surface of this loudspeaker cone type diaphragm. While the space section between the loudspeaker cone type diaphragms arranged at its aforementioned top-plate [ plate-like ] and upper part side is made into the tank section for \*\*\*\*ing an ultrasonic transmission medium A semiconductor wafer is made to turn and face the supply nozzle which sprays the liquid and gas for wet processing in order towards the front face of the semiconductor wafer which carries out high-speed rotation from the center position of the aforementioned top plate.

[0013] Furthermore, it is characterized by this invention making the aforementioned supersonic-oscillation equipment reciprocate to the front face of a semiconductor wafer, and parallel covering the distance more than the radius dimension of a semiconductor wafer.

[0014] In addition, while the ultrasonic transmission medium feed hopper to the tank section is prepared in the cone tip side of the aforementioned loudspeaker cone type diaphragm, as for the ultrasonic transmission medium exhaust port from the tank section, it is desirable to prepare in the cone \*\*\*\* side circumference of the aforementioned loudspeaker cone type diaphragm. Moreover, as for the supply nozzle of a liquid and a gas, it is desirable to pierce through the core of a loudspeaker cone type diaphragm and the tank section perpendicularly, and to pipe to a top-plate center position.

[0015]

[Operation] In the case of this invention, the front face of the wafer which carries out high-speed rotation is being worn by the top plate by which contiguity arrangement was carried out, and it is made into the narrow clearance section between the wafer front face and the top plate. For this reason, if a penetrant remover, rinse liquid, and the gas for xeraxis are sprayed on a wafer front face from a supply nozzle at the time of each processing of washing, a rinse, xeraxis, etc., these liquids and gases are shaken off by the centrifugal force of the wafer which carries out high-speed rotation in the orientation of a wafer periphery, filling the aforementioned clearance section completely.

[0016] Therefore, what says that the thing which was shaken off with the centrifugal force even if, and which enters a wafer front face and the opening between top plates though it is easy too much a penetrant remover, and liquid etc. collides with a chamber wall, and serves as Myst and it soars in a chamber is impossible, and Myst adheres and resols on a wafer front face is lost.

[0017] Moreover, even when polluted with the organic solvent to which the gas for xeraxis with which it is filled in a chamber, and the atmospheric air in a chamber remain, these pollution gas or atmospheric air cannot enter a wafer front face and the opening between top plates, and a wafer is not polluted. For this reason, difficult cluster tool-ization is attained in the conventional spin sheet processor. Moreover, since it is made to perform each processing of washing, a rinse, and xeraxis, irradiating a ultrasonic wave on a wafer front face, the effect of each processing can be raised and the processing quality of a wafer can be improved much more.

[0018] Furthermore, when supersonic-oscillation equipment is made to reciprocate to the front face of a semiconductor wafer, and parallel covering the distance more than the radius dimension of a semiconductor wafer, the liquid and gas for wet processing of a penetrant remover, rinse liquid, the gas for xeraxis, etc. can be uniformly sprayed all over the front face of the semiconductor wafer which carries out high-speed rotation. For this reason, while processing is accelerable, the wafer front face also of a fear of attaching blemishes, such as etc., for example, the concave of micron order -- it being able to scoop out -- is lost by spraying fixed one center position of wafer W

[0019]

[Gestalt of implementation of invention] Hereafter, the gestalt of enforcement of this invention is explained with reference to a drawing. The gestalt of 1 enforcement of the spin sheet processor applied to this invention at drawing 1 and drawing 2 is shown. It is the plan of the gestalt of 1 enforcement of the spin sheet processor which drawing 1 requires for the A-A view cross section in drawing 2, and drawing 2 requires for this invention.

[0020] In drawing, 1 is a chamber for performing each processing of washing, a rinse, and xeraxis, and the disc-like wafer cradle 3 which lays wafer W in this chamber 1, and carries out high-speed rotation is arranged free [ rotation ]. It connects with the motor 5 through the rotation axis 4, and by turning on and turning off a motor 5, this wafer cradle 3 is constituted so that it can rotate free.

[0021] The supersonic-oscillation equipment 6 is attached in the upper part of the aforementioned wafer cradle 3 which carries out high-speed rotation. While this supersonic-oscillation equipment 6 makes each processing of washing, a rinse, and xeraxis perform efficiently by irradiating a ultrasonic wave on the front face of wafer W which carries out high-speed rotation, it is for preventing that wafer W is resoled in the midst of each processing of washing, a rinse, and xeraxis by setting it as a relation which mentions later the physical relationship with wafer W by which high-speed rotation is carried out.

[0022] That is, the plate-like top plate 7 which constitutes the lower-base side of the supersonic-oscillation equipment 6 is made to counter wafer W carried on the wafer cradle 3, and contiguity arrangement is carried out. And the loudspeaker cone type diaphragm 8 is arranged towards the wafer cradle 3 at this top-plate 7 bottom, and it considers as the tank section 10 which \*\*\*\*s the ultrasonic transmission medium (for example, pure water) 9 for the space section between this diaphragm 8 and top plate 7 transmitting a ultrasonic wave efficiently.

[0023] furthermore, to the outside surface of the aforementioned loudspeaker cone type diaphragm 8 The ultrasonic vibrator 11 of a necessary individual (the example of illustration six pieces) is attached at equal intervals. The supersonic oscillation of the ultrasonic vibrator 11 is carried out by supplying the RF signal for supersonic oscillations (for example, 950kHz) from the high-frequency oscillator not to illustrate. It is constituted so that this supersonic oscillation may be irradiated towards the front face of wafer W through a diaphragm 8, the ultrasonic transmission medium 9 in the tank section 10, and the top plate 7.

[0024] In addition, although the transmission orientation and intensity distribution of a ultrasonic wave changed by cone tilt-angle theta of the loudspeaker cone type diaphragm 8, when quartz glass is used for the loudspeaker cone type vibrator 8 and the top plate 7 and the ultrasonic wave of 950kHz of oscillation frequency is used, for example, it is desirable according to the result of an experiment to set it as theta= 28 degrees about +-5 degrees. When it is set as this angle domain, moreover, a ultrasonic wave is emitted downward [ perpendicular ] by equal intensity distribution from the field of a top plate 7. Therefore, a ultrasonic wave can be irradiated equally [ there is no nonuniformity in the whole front face of wafer W, and ] by using rotation of a wafer together.

[0025] On the other hand, it pierces through a diaphragm 8 and the tank section 10 in the center position of the aforementioned diaphragm 8 at right angles to the vertical orientation, the cylinder-like hole 12 is formed in it, and it is rinse liquid, such as penetrant removers, such as an organic solvent, and a pure water, and N2 in this hole 12. The supply nozzle 13 for turning the gas for xeraxis of gas etc. to the front face of wafer W, and spraying it in order is \*\*\*\*ed. As for the ultrasonic transmission medium exhaust port for the ultrasonic transmission medium feed hopper for 14 supplying the ultrasonic transmission medium 9 in the tank section 10 and 15 discharging the ultrasonic transmission medium 9 in the tank section 10 to the exterior, and 16, an exhaust port and 17 are fresh air inlets.

[0026] As it is laid free [ a slide ] on the covering device 2 of a chamber 1 and the flange 18 of the periphery edge is shown in drawing 2, the above-mentioned supersonic-oscillation equipment 6 By connecting the piston rod 20 of a cylinder 19 with the end section, driving a cylinder 19, and making a piston rod 20 move It is constituted so that the supersonic-oscillation equipment 6 whole can be made to reciprocate to parallel with the front face of wafer W at the rate of predetermined (for example, below 10cm/sec) covering the distance more than radius dimension r of a wafer (it is perpendicular to space in drawing 1 drawing 2 the vertical orientation). O-ring 21 is \*\*\*\*ed between a flange 18 and the covering device 2, and the airtight in a chamber 1 is maintained.

[0027] Next, an operation of the spin sheet processor of this invention which becomes the above-mentioned configuration is explained. In addition, processing start is preceded and the ultrasonic transmission mediums 9, such as a pure water, are supplied in the tank section 10 from the ultrasonic transmission medium feed hopper 14, and it fills by the ultrasonic transmission medium 9 so that the inside of the tank section 10 may be illustrated. In addition, when this ultrasonic transmission medium 9 fills the inside of the tank section 10 to the limit, it may stop \*\*\*\*, it \*\*\*\*s constant flow continuously, and may be made to replace it by the ultrasonic transmission medium 9 little by little.

[0028] The door of the wafer receipts-and-payments opening (not shown) prepared in the side attachment wall of a chamber 1 etc. is opened first, after carrying wafer W made into a processing object on the wafer cradle 3, a door is closed and the inside of a chamber 1 is sealed.

[0029] Next, while a motor 5 is driven and high-speed rotation of the wafer cradle 3 is carried out at the rate of predetermined, a cylinder 19 is driven and the supersonic-oscillation equipment 6 whole is made to reciprocate to the front face of wafer W, and parallel covering the distance more than radius dimension r of a wafer.

[0030] Furthermore, the RF signal for supersonic oscillations (for example, 950kHz) is impressed to a ultrasonic vibrator 11 from the high-frequency oscillator not to illustrate, and a ultrasonic vibrator 11 is vibrated. The supersonic oscillation of this ultrasonic vibrator 11 is equally emitted towards the front face of wafer W which carries out high-speed rotation from the whole surface of a top plate 7 through the ultrasonic transmission medium 9 in the tank section 10, after reinforcing by the cone-like diaphragm 8.

[0031] In the above-mentioned status, penetrant removers, such as an organic solvent, are sprayed on the supply nozzle 13 from the medical fluid feeder not to illustrate towards the front face of wafer W which \*\*\*\*s and carries out high-speed rotation. Although this sprayed penetrant remover shakes at the circumferential direction of wafer W, is flown along with the slit of a top plate 7 and wafer W, flows and is left with the centrifugal force of the wafer cradle 3 which carries out high-speed rotation Since the ultrasonic wave is irradiated towards the wafer front face at this time, in order that the foreign matters adhering to the wafer front face, such as dirt and a particle, may lose touch with a wafer front face by the supersonic oscillation and the penetrant remover may flush this place to which it came floating, A wafer front face can be washed very effectively.

[0032] Although the penetrant remover shaken off from the periphery edge of wafer W may collide with a chamber wall, and may serve as Myst, it may ride on the draft (the arrow head of a dotted line showed in drawing 1 ) accompanied by high-speed rotation of the wafer cradle 3 and it may soar in a chamber with a centrifugal force as mentioned above Since the front face of wafer W sets few clearances in the case of this invention and the whole surface is being worn by the top plate 7 of the supersonic-oscillation equipment 6, Myst which soared in the chamber does not carry out the reattachment to a wafer front face.

[0033] Moreover, since the supersonic-oscillation equipment 6 has reciprocated to the front face of wafer W, and parallel in the cylinder 19 covering the distance more than radius dimension r of a wafer, penetrant removers, such as an organic solvent sprayed from the supply nozzle 13, are uniformly sprayed over the whole surface of wafer W. for this reason, while washing processing is accelerated, the wafer front face also of a fear of attaching blemishes, such as etc., for example, the concave of micron order -- it being able to scoop out -- is lost by spraying fixed one center position of wafer W

[0034] Next, it sprays towards the front face of wafer W which rinse liquid, such as a pure water, is \*\*\*\*ed for the supply nozzle 13 from a liquid feeder by rinsing, and carries out high-speed rotation not to illustrate. With this centrifugal force of the wafer [ which was sprayed ] cradle 3 which rinses and carries out high-speed rotation of the liquid, although it is shaken and flown towards a circumferential direction, it flows from the center position of wafer W along with the slit of a top plate 7 and wafer W and it goes away Since the ultrasonic wave is irradiated towards the wafer front face at this time, and the foreign matters adhering to the wafer front face, such as penetrant-remover grain and dust, come floating to a wafer front face, rinse this place to which it came floating, they are liquid and are rinsed by the supersonic oscillation, A wafer front face can be rinsed very effectively.

[0035] Although also in this rinse processing it rinses, and liquid may collide with a chamber wall, and may serve as Myst, and it may ride on the draft accompanied by high-speed rotation of the wafer cradle 53 shaken off from the periphery edge of wafer W and it may soar in a chamber with a centrifugal force, as mentioned above, since the wafer front face is being completely worn by the top plate 7 which carried out contiguity arrangement, this Myst that soared does not carry out the reattachment of it to a wafer front face.

[0036] Moreover, rinse liquid's sprayed from the supply nozzle 13 since the supersonic-oscillation equipment 6 has reciprocated as mentioned above worries about occurrence of the blemish on the front face of a wafer by blasting of rinse liquid also disappear while rinse processing is accelerated, since it is uniformly sprayed over the whole surface of wafer W.

[0037] Next, it is N2 from the gas supply system for xeraxis not to illustrate to the supply nozzle 13. The gas for xeraxis of gas etc. is sprayed towards the front face of wafer W which \*\*\*\*s and carries out high-speed rotation. Along with the slit of a top plate 7 and wafer W, this sprayed gas for xeraxis is shaken and flown towards a circumferential direction, flows, and is left from the center position of wafer W, with the centrifugal force of the wafer cradle 3 which carries out high-speed rotation, and xeraxis processing on the front face of a wafer which got wet with rinse liquid is performed.

[0038] Since the slit between a top plate 7 and wafer W is in the status that it was completely filled by the pure gas for xeraxis which is sprayed from the supply nozzle 13 also in this xeraxis processing, neither the gas for the xeraxis after xeraxis processing nor the atmospheric air in a chamber can enter. For this reason, even when the gas for the xeraxis after xeraxis processing and the atmospheric air in a chamber are polluted even if, what says that a wafer front face is polluted by these is lost.

[0039] Moreover, the gas for xeraxis sprayed from the supply nozzle 13 the same with having mentioned above is N2 while xeraxis processing is accelerated, since it is uniformly sprayed over the whole surface of wafer W. The worries about occurrence of the blemish on the front face of a wafer by blasting of gas also disappear.

[0040] When the above-mentioned xeraxis processing is completed, while a motor 5 and the cylinder 19 are stopped, a RF signal disconnection is carried out from the ultrasonic wave oscillator not to illustrate, and wafer W which suspended equipment and processing finished is taken out from the inside of a chamber 1. And while wafer W which this processing finished is transported to the following process, the following wafer W is carried on the wafer cradle 3, and a series of processing of above-mentioned washing and an above-mentioned rinse, and xeraxis is repeated.



[0041] In addition, in order to prevent gassing by the supersonic oscillation as an ultrasonic transmission medium 9 poured into the aforementioned tank section 10, it is desirable to use the pure water which carried out degasifying processing. Moreover, as for the ultrasonic transmission medium exhaust port 15 for discharging the ultrasonic transmission medium 9, it is desirable to prepare near the cone tip of a loudspeaker cone type diaphragm so that it may illustrate. Thus, if it prepares near a cone tip, even when the foam is generated within the tank section 10, the natural exhaust air of the generated foam should be carried out from the ultrasonic transmission medium exhaust port 15 by the side of this upper part. Moreover, natural \*\*\*\* also of the generation of heat by the supersonic oscillation can be carried out.

[0042] Moreover, although it pierced through the core of a diaphragm 8 and the tank section 10 at right angles to the vertical orientation and it was drawn to the top-plate center position, it is not necessary to pierce through the core of a diaphragm 8 and the tank section 10, and to necessarily, prepare it, and the supply nozzle 13 should just be \*\*\*\*\* towards the wafer front face from the center position of a top plate at least in the supply nozzle 13 with the gestalt of the aforementioned implementation.

[0043]

[Effect of the invention] As explained above, according to invention of claim 1 publication, by carrying out contiguity arrangement on the front face of the wafer which arranges supersonic-oscillation equipment to the wafer up side which carries out high-speed rotation, and carries out high-speed rotation of the top plate of this supersonic-oscillation equipment Since the narrow clearance along which only the liquid and gas of a penetrant remover, rinse liquid, the gas for xeraxis, etc. required for wet processing pass was formed between the wafer front face and the top plate The thing which was blown away with the centrifugal force at the time of each processing work of washing, a rinse, and xeraxis and these Myst carries out [ a thing ] the reattachment to a wafer front face though it is easy too much a penetrant remover, liquid serves as Myst and it soars in a chamber is lost. For this reason, resoiling of a wafer can be prevented.

[0044] Moreover, since it is made to perform each processing of washing, a rinse, and xeraxis, irradiating a ultrasonic wave equally on a wafer front face, the homogeneity of surface treatment can improve and the processing quality of a wafer can be improved. Moreover, since it is not influenced of the gas for xeraxis after using it for xeraxis processing, or the atmospheric air in a chamber, by gas or the atmospheric air, it is lost to these that a wafer is polluted and a spin sheet processor can be formed into a cluster tool to them.

[0045] Moreover, according to invention of claim 2 publication, since it was made to make supersonic-oscillation equipment reciprocate to the front face of a semiconductor wafer, and parallel covering the distance more than the radius dimension of a semiconductor wafer, it can spray uniformly all over the front face of the semiconductor wafer which carries out high-speed rotation of the liquid and gas for wet processing. For this reason, while processing is accelerable, occurrence of the blemish on the front face of a wafer by spraying fixed one center position of a wafer etc. can be prevented.

[0046] Moreover, since according to invention of claim 3 publication the ultrasonic transmission medium exhaust port from the tank section was prepared in the cone \*\*\*\* side circumference of a loudspeaker cone type diaphragm while the ultrasonic transmission medium feed hopper to the tank section was prepared in the cone tip side of a loudspeaker cone type diaphragm, generation of heat accompanied by the foam and supersonic oscillation which are generated by tank circles can be automatically discharged to the exterior, and the stable processing operation can be made to perform.

[0047] Moreover, since according to invention of claim 4 publication it pierced through the core of a loudspeaker cone type diaphragm and the tank section perpendicularly and the supply nozzle of a liquid and a gas was piped to the top-plate center position, the ultrasonic developmental mechanics fraction of supersonic-oscillation equipment serves as symmetrical structure over all the orientation that is 360 degrees, and can irradiate a ultrasonic wave on a wafer front face more at homogeneity. For this reason, the homogeneity of surface treatment can improve and the processing quality of a wafer can be improved much more.

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[Translation done.]